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# NEW VOLCANOES AND A NEW MOUNTAIN RANGE

By Professor Emeritus WILLIAM H. HOBBS

UNIVERSITY OF MICHIGAN

IN Michoacan province, some two hundred miles due west of the city of Mexico, a volcano was born above a cornfield on February 20, 1943, is already more than 1,500 feet in altitude and is still in a lusty growth. It has been christened *El Parícutin*. The event has figured in world news, and the volcano has been visited by throngs of tourists from the city of Mexico. Already an account of this unusual event has been printed in SCIENCE (December 10, 1943) and the occurrence has been pronounced unique in history.

What is so unusual is the birth and growth of a volcanic mountain *away from other volcanoes,* for scores of such mountains have been observed as they have been born upon the flanks of giant volcanoes, such as Etna, and phenomena in all respects comparable to those observed at Parícutin are therefore familiar to volcanologists.

As I shall show, the birth of a volcano like Parícutin, which is some tens of miles distant from other volcanoes, is not unique. Below are listed seven such births recorded in literature, all from the Christian era,[1] and there must have been others which are not of record:

NEW VOLCANOES (IN ORDER OF THEIR BIRTHDAYS)

*Monte Nuovo* (New Mountain), September 29, 1538. Bay of Naples. 440 feet high. Description by Lyell in "Principles of Geology," Vol. 1, pp. 607–619, on the basis of accounts by contemporary observers. Important gun position in the shelling of Naples, 1943.

*Jorullo.* September 28, 1759. Province of Michoacan, Mexico. 1,600 feet high. Rose above the plain of Malpais. Described by v. Humboldt in *Cosmos.* Fumerole action as late as 1906.

*Izalco.* February 23, 1769. San Salvador. 1,900 feet

[1] Strabo in his "Geography" has reported two earlier births, that of Madane during the third century B.C. and a submarine eruption in 196 B.C., both in the Aegean. Many submarine eruptions in new localities are of record, the best known that of Nwöe Island (New Island), thirty miles off Cape Reykianes, Iceland, in May, 1783; and Graham Island between Sicily and Tunisia, July, 1831. Unless eruption is long continued such islands are cut away by the waves and are subsequently marked only by shoals.

high. Thrown up in a region used by farmers and herders of cattle. Important later eruptions in 1798, 1803, 1856, 1869, 1873. Still very active with latest eruptions in 1927 and 1939. Account by F. de Montessus de Ballore, "Tremblements de terre et éruptions volcaniques au centre-Amerique," Dijon, 1888, pp. 108–110.

*El Nuevo* (The New One). April 11, 1850. Also called *Volcan Nuevo* and *Cerro Negro*. Near Léon, Nicaragua. 650 feet high. Thrown up on a plain of ancient lava. Described by F. de Montessus de Ballore, *loc. cit.*, pp. 137–138.

*Pochutla*. 1870. Province of Oaxaca, Mexico. Briefly referred to by Neumayr in "Erdgeschichte," Vol. 1, 1887, p. 245.

*Camiguin*, July, 1871. Near Catarman Village on Camiguin Island, Philippines. 1,860 feet high. Thrown up over a flat section of the coast during the cruise of the *Challenger*. Described and figured in "*Challenger* Reports, Narrative," Vol. 1, second part, p. 653.

*El Parícutin*. February 20, 1943. Province of Michoacan, Mexico. 1,500 feet or more in height. Described by Parker D. Trask in SCIENCE of December 10, 1943.

El Parícutin is thus the latest of new volcanoes in a registered list. Five of the seven recorded—El Nuevo, Izalco, Pochutla, Jorullo and El Parícutin—were all (1) born in either Mexico or Central America, (2) during the last two hundred years, and (3) along a line close to and parallel with the Pacific coast. (See map.)

Though the birth of Parícutin is not an isolated example, the birth and growth of a mountain range which is outlined by a number of known new volcanoes is absolutely unique. Evidence of the rising range is not restricted to the existence of a line of new volcanic vents. It includes (1) volcanic activity, (2) seismicity, (3) a rising coastal ridge and (4) an offshore trough.

(1) *Volcanic activity*. Speaking broadly, the age of volcanoes is measured in terms of their stature, increasing mass being as a rule accompanied also by decreasing activity. Old volcanic mountains are large because they are built up from the extruded lavas. The monarchs of the Mexican region—Orizaba, Ixtaccihuatl, Popocatepetl, Ajusco, Toluca, San Andres and Zamora—have summits from 12,000 to 17,000 feet in altitude, and they were built up during the Tertiary age on an east-west line behind a great mountain range. This range was parallel to the coast of the ocean of that time, one that separated North from South America. The rise of the range has now been largely completed, earthquake activity has largely ceased, and the great volcanoes are nearly or quite extinct.

To-day a range is rising parallel to the Pacific Ocean and the five known new volcanoes are ranged at its back in line with many others, all of them young and mostly active.[2] They are for the most part still of moderate size—about a third that of the earlier east-west series near the latitude of Mexico City (see map). Of those volcanoes in the new series of whose birth we have no record, one, Coseguina, was very likely born near the beginning of the nineteenth century; for though the region had been occupied by the Spaniards since the coming of the *Conquistadores* in the early sixteenth century, the eruption of 1835, one of the grandest in volcano history, is the beginning of the known history of the vent. Another active volcano is Colima at the intersection of the new with the old volcano line, but its active history likewise begins early in the nineteenth century. Its latest eruption was in 1941. Beyond Colima to the northwest activity dies out in Solfataric emanations at Guadalahara, inland from Cape Corrientes, and the circum-Pacific volcano belt is next continued in northern California. To the southward the line of volcanoes comes to an end short of Panama with the active vents in Costa Rica, where the line is separated by a wide gap from the volcanoes of Equador. (See map at end.)

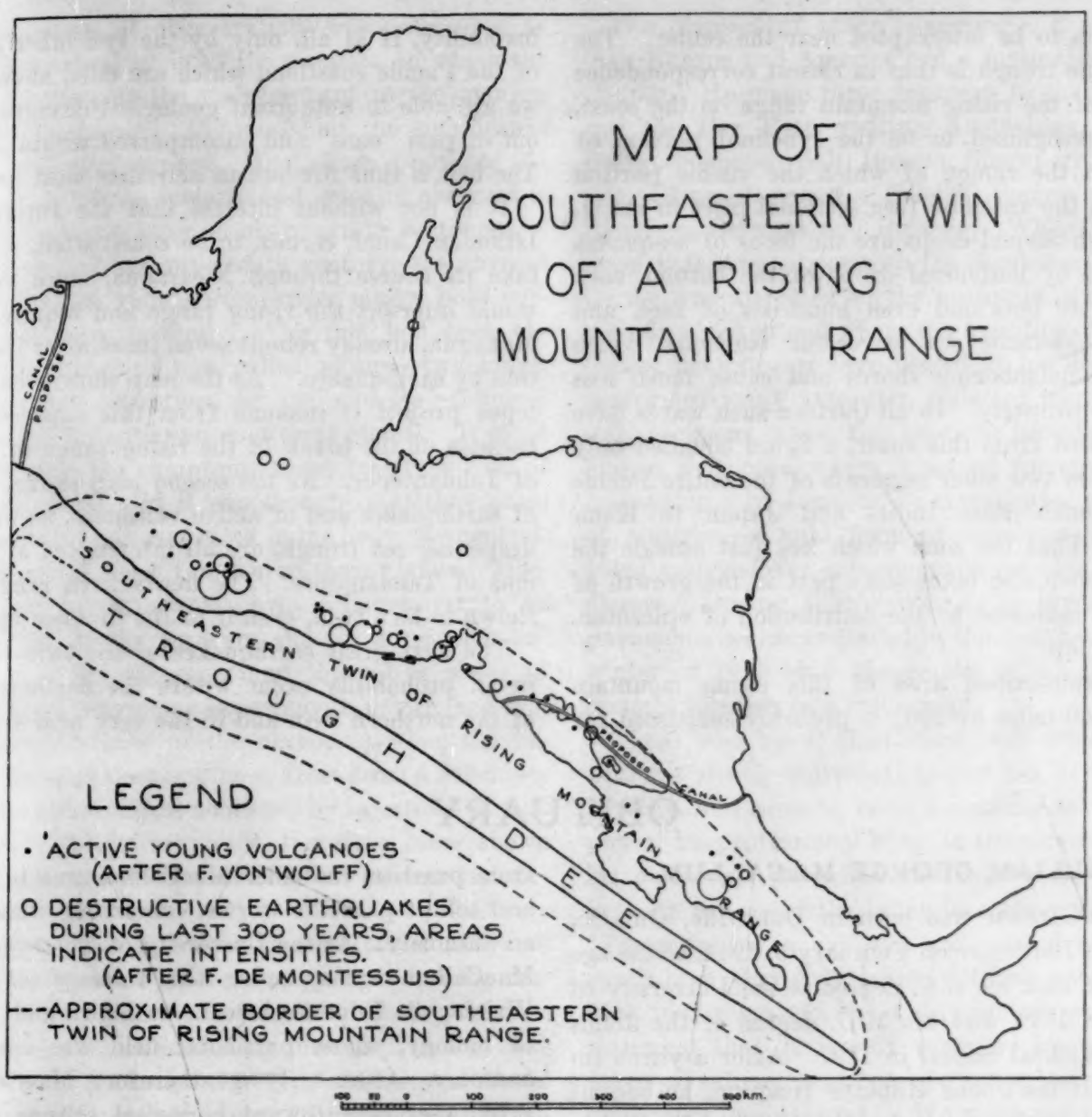
(2) *Seismicity*. All the destructive earthquakes of the region during the twentieth century have occurred within the new rising range, the *Sierra Madre del Sur*, at the back of which is the line of new and youthful volcanoes (see map). If all historic earthquakes are taken into account the distribution is found to be the same.[3] Of thirteen lighter earthquakes in Mexico and Central America, yet important enough to be mentioned in dispatches to *The New York Times* during the last five years, all were from within the area of this new mountain belt.

(3) *A rising coastal ridge*. Between the line of active young volcanoes and the coast is a mountain range, the Sierra Madre del Sur. Its seaward slope is steep and marked by wave-cut terraces, a "coastal staircase," bearing witness to the fact that the land has here lately risen from the level of the sea to its present altitude. The "risers" in the staircase measure the jolting uplifts of greater earthquakes, as the "treads" do the work of sea waves during the intervening periods.

(4) *Offshore phenomena*. Offshore from the rising ridge (between Cape Corrientes at the northwest and Panama to the southeast) at distances varying from seventy to one hundred miles, there extends a deep trough in the sea discovered in 1924, which is steeper toward the land and with depths of from 3,000 to 3,500 fathoms (from over three and one half miles). This trough narrows and shallows toward each end,[4]

[2] To avoid confusion they are not entered on the map. They are mainly in Central America. (See map at end.)

[3] F. de Montessus de Ballore, "La Géographie Séismologique," figs. 66 and 67, pp. 385 and 397.


MAP OF
SOUTHEASTERN TWIN
OF A RISING
MOUNTAIN RANGE
CANAL PROPOSED
SOUTHEASTERN TWIN OF RISING MOUNTAIN RANGE
TROUGH DEEP
PROPOSED CANAL
LEGEND
ACTIVE YOUNG VOLCANOES (AFTER F. VON WOLFF)
DESTRUCTIVE EARTHQUAKES DURING LAST 300 YEARS, AREAS INDICATE INTENSITIES. (AFTER F. DE MONTESSUS)
---APPROXIMATE BORDER OF SOUTHEASTERN TWIN OF RISING MOUNTAIN RANGE.
km.

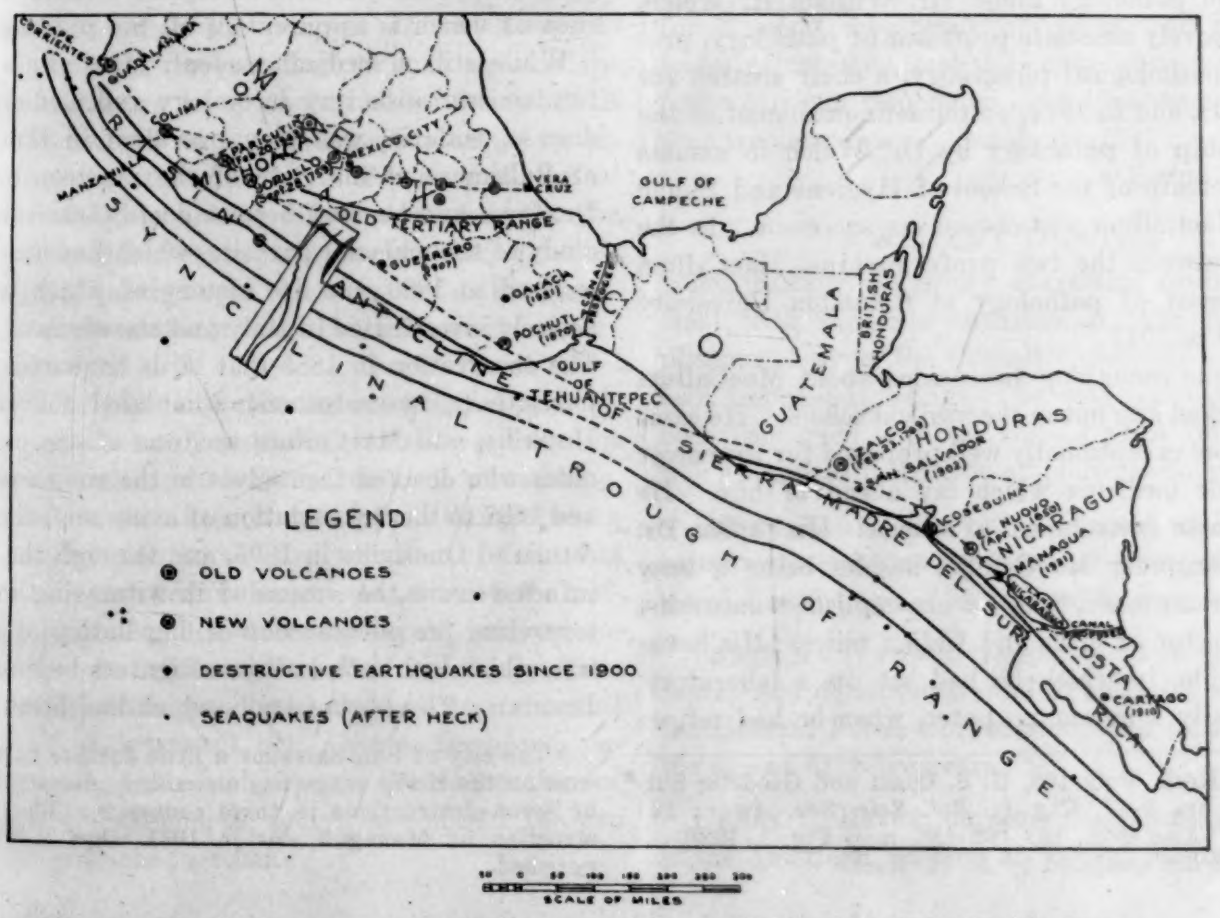



**FIG. 1. Map to show a new mountain range rising on the border of the Pacific Ocean.**

and appears to be interrupted near the center. The extent of the trough is thus in closest correspondence with that of the rising mountain range on the coast, and it is recognized to be the synclinal portion of the fold in the range, of which the visible portion on shore is the anticline (see sectional inset in map). Such trough-shaped deeps are the locus of seaquakes represented by individual drops of the bottom, each amounting to tens and even hundreds of feet, and these cause seismic sea waves, or tsunamis, which invade the neighboring shores and cause much loss of life and property. In all thirteen such waves have been recorded from this coast, a figure equalled only by that from two other segments of the entire Pacific border (Dutch East Indies and Japan to Kamchatka).[5] That the zone which lies just outside the trough proper also takes some part in the growth of the fold is indicated by the distribution of epicenters upon the map.

The circumscribed area of this rising mountain range (1,500 miles by 200) is probably surpassed for instability, if at all, only by the two other segments of the Pacific coastland which are cited above. Here we are able to note great geological changes brought out of past "eons" and encompassed within centuries. The belt is thus for human activities most dangerous.

It is not without interest that the future second Isthmian Canal, certain to be constructed, should not take its course through Nicaragua, since that route would intersect the rising range and require locks at Managua, already rebuilt seven times after its destruction by earthquakes.[6] As the map shows, the Tehuantepec project is immune from this supreme hazard because of the break in the rising range at the Gulf of Tehuantepec. As the second map shows, the belts of earthquakes and of active volcanoes, as well as the deepening sea trough, are all interrupted at the Isthmus of Tehuantepec. The newly born range is thus shown to be a twin, even if of the Siamese variety.

The next great earthquakes of the twin-range will in all probability occur within the northern portion of the northern twin and in the very near future.

[4] N. H. Heck, Pub. 108, U. S. Coast and Geodetic Survey, 1824, pp. 3–17, Fig. 1; *Bul. Seis. Soc. Amer.*, 14: 200, 1924. Also *ibid.*, 16: 182–186, map Fig. 1, 1926.

[5] From a list compiled by N. H. Heck.

[6] The city of San Salvador a little farther to the northwest on the rising range has a similarly disastrous history of seven destructions in three centuries. The latest destruction of Managua was in 1931 when 2,000 persons perished.

# OBITUARY

## WILLIAM GEORGE MacCALLUM

DR. MACCALLUM was born in Dunnville, Ontario, and died in Baltimore on February 3, 1944, at the age of 70. He took his B.A. degree at the University of Toronto in 1894, and his M.D. degree at the Johns Hopkins Medical School in 1897. After a year's interneship at the Johns Hopkins Hospital, he became assistant in pathology under Dr. William H. Welch, and successively associate professor of pathology, professor of pathological physiology, a chair created for him in 1908, and in 1917, on the relinquishment of the professorship of pathology by Dr. Welch to assume the directorship of the School of Hygiene and Public Health, MacCallum was chosen his successor. In the interval between the two professorships, MacCallum was professor of pathology at Columbia University from 1909 to 1917.

There was something precocious about MacCallum which marked him out in the medical school. He came to the school exceptionally well prepared for the career in scientific medicine which lay ahead of him. He grew up in an environment of science. His father, Dr. George Alexander MacCallum, besides being a busy general practitioner, was an accomplished naturalist and a collector of birds and Indian relics. His house in Dunnville, in which he had set up a laboratory, was virtually a museum. Later, when he had retired from practice, the elder MacCallum was to write on and collect parasitic worms, concerning which he was an authority. At the University of Toronto, William MacCallum came under the tutelage of Ramsey Wright, an Edinburgh man, zoologist and professor of biology, whose particular field was comparative anatomy. At an early age, therefore, MacCallum was given that bent toward biological science the influence of which is apparent in all his published work.

While still a medical student, MacCallum made a fundamental discovery in biology and medicine. The disease, malaria, was very prevalent in the environs of Baltimore at the close of the nineteenth century. Dr. Osler and his staff became deeply interested in the study of the malarial parasite, which Laveran had discovered in 1880, the life history of which was being actively investigated in Italy and elsewhere at the time. The observation in 1885 that birds harbored a similar parasite (a haematozoon) stimulated the studies at Hopkins, and MacCallum was one of the undergraduates who devoted themselves in the summers of 1896 and 1897 to the investigation of avian malaria. On his return to Dunnville in 1897, and through the study of infected crows, he succeeded in witnessing and in interpreting the phenomenon of flagellation of the parasite, which had baffled all investigators beginning with Laveran. The phenomenon, which had been regarded

as an indication of degeneration, was recognized as part of the sexual cycle of the parasite, in which the flagella function as the male element in the manner of the spermatozoon. Convinced of the significance of the fertilizing process, MacCallum predicted its occurrence in human malaria and actually observed it there a few months later on his return to Baltimore.

At the end of the nineteenth century, the thyroid and parathyroid glands were under study, both surgically and experimentally. The fact had been observed that the condition called tetany—twitchings, quiverings and vibrations of the muscles—followed sometimes on the extirpation of these glands. It could be shown that the symptoms arose from the loss of the parathyroids, and it was thought that they arose from a poison-toxin generated in the body, the neutralization of which was a function of these glands. MacCallum and his associates devoted themselves to an investigation of the problem and, in a research extending over several years and through a series of ingenious and convincing experiments, determined that the hyperexcitability of the nervous system, the immediate cause of the symptoms, arose from a deficiency of calcium and could be abolished by injections of that substance. The parathyroids, therefore, were shown to exercise a special influence over the calcium metabolism of the body.

MacCallum was a teacher who attracted many advanced pupils to his laboratory, students looking forward often to academic careers in pathology and in clinical medicine. His attitude toward pathology was a broad one. As early as 1905, he developed at the medical school practical courses in pathological physiology, an innovation the purpose of which was to bridge a gap between pathological anatomy and the clinical subjects. As pathological anatomy deals chiefly with the end results of disease, he aimed by experimental means to reproduce in animals pathological conditions which could be observed directly by the senses and studied through the use of every possible instrument of precision, in the same way as the physiologist investigates the normal functions of the tissues and organs.

MacCallum was the author of an original and admirable text-book of pathology, which reflects his point of view and sets forth his methods of teaching. Published first in 1916, it has gone through seven editions. The plan he adopted was that of following the effects of the various causes that disturb the natural functions and produce the gross and microscopical changes in the tissues and organs, the basis of disease and the resulting physical and chemical changes which interrupt life. Since, therefore, pathology accompanies and even is the foundation of all clinical phenomena, he sought to consider the two sets of occurrences together.

The diseases of other countries and other climes than Europe and America had a fascination for MacCallum. He made three journeys to the South Seas and the Far East, visiting Australasia, the Dutch Indies, including Bali, Borneo, Singapore, Siam, Manila, China, Japan, the Celebes, Saigon and Ankor, Rangoon, Calcutta and Bombay. While he observed these distant countries with the eager eye of the tourist, he was attracted to the hospitals, where he was warmly received and where the facilities of the pathological laboratories were placed at his disposal. He performed many autopsies, collected many pathological specimens, which rich booty he brought back with him to Baltimore, where it served for study and for instruction. In Jamaica, he investigated an epidemic of alastrim—a mild form of smallpox—which provided material for a monograph on that interesting disease. During World War I, he investigated the pneumonia which prevailed in the Army camps in the winter of 1917–1918, the results of which were also brought together in a monograph.

Those who knew MacCallum well were impressed with his strong individuality and his delightful personality, and came to know something of the philosophy of his professional life. In the seventh edition of his pathology, published not long before his last illness, he expressed the latter in a characteristic way: "The advances in medicine and related sciences have again been very great since the last revision of this book four years ago, but it still reminds us of Goethe's statement that 'it is only when we know very little about a subject that we are quite sure; and with knowledge doubt grows.' We must not be dogmatic, for it seems that before us paths lead into a dark forest of mystery, and it is only when we shall have followed them into outer light that we can feel that we have cleared away our doubts."

SIMON FLEXNER

## RECENT DEATHS

DR. ROBERT ANTHONY HATCHER, until his retirement with the title emeritus in 1935 professor of pharmacology at the Cornell University Medical College, has died at the age of seventy-six years. He had been connected with the college since 1904, when he was appointed instructor of pharmacology.

HENRY LLOYD SMYTH, professor of mining and metallurgy emeritus of Harvard University, died on April 1 at the age of eighty-two years.

LEWIS W. WATERS, vice-president in charge of research and development and of scientific relations for the General Foods Corporation, died on March 31 at the age of fifty-five years.

HENRY C. RAVEN, curator of comparative anatomy at the American Museum of Natural History, associate

in zoology at Columbia University, died on April 6 in his fifty-fifth year.

DR. WARREN TAYLOR VAUGHAN, of Richmond, Va., specialist in the treatment of allergic diseases, died on April 2. He was fifty-one years old.

GEORGE ALEXANDER ORROK, consulting engineer, from 1898 to 1916 mechanical engineer of the New York Edison Company, known for his work on power plant engineering, died on April 7 at the age of seventy-seven years.

ARNE FISHER, for twenty-four years mathematician of the Western Union Telegraph Company in New York, died on April 8. He was fifty-seven years old.

SIR CHARLES VERNON BOYS, physicist of Andover, England, died on March 31. He was eighty-nine years old.

# SCIENTIFIC EVENTS

## THE LENINGRAD CENTER FOR SCIENTIFIC WORKERS

THE blockade of Leningrad temporarily interrupted the work of the Leningrad Center for Scientific Workers, of which Professor L. Veriga, doctor of physics and mathematics, is chairman. Its work is described in the *Information Bulletin* of the Embassy of the USSR as follows:

Only in the spring of 1942 were the 367 scientific workers who remained in the city able to renew the activities of the center, which naturally adapted its efforts to the requirements of the front and of the beleaguered city.

Six sections began work immediately, and 17 sections were functioning by the summer of 1943. Those working in the realm of agriculture took up the problem of rationalizing vegetable gardening. Their conclusions led to two important decisions by the Leningrad Municipal Soviet—on the application of quick crop methods in potato growing and the adaptation of a new bacteriological and nitrogenous fertilizer.

A number of popular booklets on these subjects were published, and several consultation stations for aid to gardeners organized. Lectures advocating the adaptation of new agro-technical methods were held at all state farms in the Leningrad zone, and 600 talks were made to agricultural workers. Winter gardens and experimental hothouses were a part of the program.

The section on mechanical engineering devoted itself to the problem of utilizing damaged and worn machines and equipment. Its members came to the aid of the Leningrad power stations and assisted in their reconstruction. Much work was done on new and vital problems in the field of industrial chemistry. The entire body of scientific workers discussed an important paper on "Ways and Means of Keeping the City Clean in the Winter of 1942–43." Many suggestions were made which greatly facilitated this task.

A section on inventions examined all proposals for strengthening the city's defense and improving the municipal economy. The food section concentrated on the problem of extending and utilizing fully the food resources of Leningrad and of vitaminizing the rations.

During the first half of 1943, workers in the literary and historical sections held six sessions devoted to the great masters of Russian literature—Lomonosov, Pushkin, Belinsky, Gorky, Derzhavin, Chernishevsky and Lermontov. A voluminous collection of themes relating to the present war was published.

The scientific workers of Leningrad have renewed their traditional work with the Baltic Fleet, delivering lectures on the most varied topics to the different naval units. During the past six months over a thousand such lectures have been given on board ships and at naval hospitals.

Many who had prepared themes were unable to receive their degrees because of the evacuation of universities and scientific institutes; nevertheless, work on themes continued and numerous papers have been completed during the war. A year ago a rest home was opened for scientific workers.

## THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

THE fifth annual report of the National Foundation for Infantile Paralysis has been made public. It shows that during the fiscal year ended September 30, 1943, grants and appropriations were made amounting to $1,278,836 in five main categories—virus research, research on after-effects, education, medical publications, and epidemics and public health. The local chapters which provide care for poliomyelitis patients in their areas receive half the funds raised each January from the celebrations of President Roosevelt's birthday. General administrative expenses for the year amounted to $84,970.

The sum of $107,000 has been spent for the training of Kenny technicians at the University of Minnesota alone, where the evaluation of the method was first undertaken under the auspices of the foundation. Since the first course in the method was given there in March, 1942, more than nine hundred physicians, nurses and technicians have been trained. Other centers have been opened at institutions in California, Illinois, Indiana, Georgia, Pennsylvania and New York. Grants to these institutions amount to $140,000 to date.

In all more than $500,000 has been spent in testing and evaluating the Kenny method and in training. Recently a five-year grant of $175,000 was made to the University of Minnesota for the purpose of studying the physiological problems concerned with the

mechanism of the disease process and methods of treatment.

## THE PROPOSED TRAINING OF FOREIGN ENGINEERS IN THE UNITED STATES

THE General Engineering Staff of the Foreign Economic Administration has, according to *The New York Times,* adopted a report prepared by Edgar J. Gealy, head industrial engineer, in regard to a plan to train in American engineering colleges after the war from 3,000 to 4,000 foreign technical graduates from Europe and Asia so that they can return after eighteen months of study to help in the reconstruction of their own lands. Students will be selected by the foreign governments with the advice of educational leaders of the United States. All students will receive practical working experience in industry for a third of the course. At college they will be under the direct supervision of the college authorities.

Courses have been developed or are under preparation at the Carnegie Institute of Technology, the Colorado School of Mines, the Illinois Institute of Technology, the Massachusetts Institute of Technology, Northwestern University, Pennsylvania State College, the Philadelphia Textile Institute, Purdue University, the University of Detroit, the University of Illinois, the University of North Carolina, the University of Michigan, the University of Utah, the University of Wisconsin and Union College.

Expenses are estimated at $3,600 for each student. Most of the money will be provided by the foreign countries concerned. The Federal Government proposes, however, to contribute an unspecified percentage.

In addition to the training of foreign students, the colleges will provide training for technical graduates of this country who wish to prepare for foreign service. Because of the complete destruction of many engineering centers in Europe, it will be necessary for the United States to assist in rebuilding the foreign industrial systems. It is expected that to a considerable degree foreign industries will depend upon American engineers and that from 5,000 to 10,000 American students will be trained for foreign service.

## THE NUTRITION FOUNDATION

GRANTS amounting to $131,000 for research in nutrition were made by the Board of Trustees of the Nutrition Foundation, Inc., at a recent meeting held in New York. They are distributed among twenty-three colleges and universities in the United States and Canada and include the renewal of grants for thirty-one research projects already in progress and three additional grants for studies at Harvard, Yale and Cornell Universities.

George A. Sloan, president of the foundation, stated that action had been taken looking towards assisting in so far as possible in the post-war placement of personnel trained in research.

Dr. C. G. King, scientific director, made the following statement:

> Research projects having the greatest value thus far were "those dealing with army rations, human protein requirements, maternal and infant nutrition, dental caries and human vitamin requirements.

New grants authorized at the meeting were as follows:

*Harvard University:* For training physicians in the human and public health aspects of nutrition.

*Yale University:* In support of studies on maternal and infant nutrition, based on carefully controlled nutrient intakes of primates—other animals having been found not so satisfactory for the study of numerous human problems such as dental caries, physical deformities or functional impairment.

*Cornell University:* For study of the biochemical mechanism of converting starches and sugar into fat.

The colleges and universities receiving grants include:

Columbia University; Cornell University; Duke University; Harvard University; Johns Hopkins University; Massachusetts State College; New York University; Northwestern University; Oklahoma Experiment Station; Ontario Agricultural College; Oregon State College; Purdue University; Stanford University; University of California; University of Cincinnati; University of Illinois; University of Minnesota; University of Rochester; University of Toronto; University of Wisconsin; Vanderbilt University and Yale University.

## NEW FELLOWS OF THE ROYAL SOCIETY

The Royal Society, London, elected on March 16 the following fellows:

Brigadier Ralph Alger Bagnold, explorer.

Ronald Percy Bell, fellow of Balliol College, Oxford.

Cecil Reginald Burch, research physicist, University of Bristol.

Subrahmanyan Chandrasekhar, astronomy, associate professor, University of Chicago, formerly fellow of Trinity College, Cambridge.

George Edward Raven Deacon, member, scientific staff of Discovery Committee, Colonial Office.

Sir Jack Cecil Drummond, professor of biochemistry, University College, London, and chief scientific adviser to the Ministry of Food.

Alexander Thomas Glenny, immunologist, Wellcome Physiological Research Laboratories, Beckenham.

Ronald George Hatton, director, Fruit Research Station, E. Malling.

Robert Downs Haworth, professor of chemistry, University of Sheffield.

William Ogilvy Kermack, research chemist, Royal College of Physicians, Edinburgh.

Franklin Kidd, superintendent, Low Temperature Research Station, University of Cambridge.

Bryan Austin McSwiney, professor of physiology, St. Thomas's Hospital, University of London.

Guy Frederic Marrian, professor of medical chemistry, University of Edinburgh.

Michael Polanyi, professor of physical chemistry, University of Manchester.

Alec Sand, comparative physiologist, Marine Biological Station, Plymouth.

Sir William Arthur Stanier, chief mechanical engineer, London Midland and Scottish Railway.

Cyril James Stubblefield, senior geologist, Geological Survey of Great Britain.

Oscar Werner Tiegs, zoologist, University of Melbourne, Australia.

Hendrik Johannes Van Der Bijl, research physicist, director of war supply, Union of South Africa, vice-chancellor, Pretoria University.

John Henry Constantine Whitehead, university lecturer and fellow of Balliol College, Oxford.

# SCIENTIFIC NOTES AND NEWS

DR. ALEXANDER LIPSCHUTZ, director of the department of experimental medicine of the Chilean National Health Service at Santiago, has been selected the recipient of the second Charles L. Mayer $2,000 prize, which is administered by the National Science Fund of the National Academy of Sciences, of which Dr. William J. Robbins, director of the New York Botanical Garden, is chairman. The award was offered for "an outstanding contribution made in 1943 to present-day knowledge of factors affecting the growth of animal cells, with particular reference to human cancer." The advisory committee consisted of Dr. R. R. Williams, chemical director of the Bell Telephone Laboratories; Dr. Alan Gregg, director for the medical sciences of the Rockefeller Foundation, and Dr. Peyton Rous, of the Rockefeller Institute for Medical Research. The formal presentation of the award will be made late this month at the annual meeting in Washington, D. C., of the National Academy of Sciences.

THE American Ambassador to Great Britain, John G. Winant, acting in behalf of the American Geographical Society of New York, at a ceremony in London on March 31 presented the Charles P. Daly Medal to Sir Halford Mackinder, the English geographer and statesman, and the Cullum Geographical Medal to Arthur R. Hinks, F.R.S., secretary of the Royal Geographical Society and Gresham lecturer in astronomy.

DR. WALTER THOMAS, professor of plant nutrition at the Pennsylvania State College, has been awarded the Charles Reed Barnes honorary life membership for 1943 in the American Society of Plant Physiologists "for outstanding researches in the mineral nutrition of plants."

DR. WILLIS R. WHITNEY, honorary vice-president of the General Electric Company and first director of its research laboratory, has been elected an honorary member of the Electrochemical Society. The certificate of honorary membership will be conferred on him at the Milwaukee meeting.

THE Dye Works of E. I. du Pont de Nemours and Company at Deepwater Point, N. J., has been named the "Chambers Works" in honor of Dr. Arthur D. Chambers, manager of the Dyestuffs Division of the Department of Organic Chemistry. He is retiring after serving the company forty-seven years. At a dinner given in his honor on April 4 he was presented with a watch by the staff of the Organic Chemicals Department at Wilmington.

H. HAROLD HUME, provost of the College of Agriculture of the University of Florida, has received from Swarthmore College the Arthur Hoyt Scott Garden and Horticulture Award for 1944. This award is $1,000 and a gold medal is given yearly "to that individual, organization or agency which, in the opinion of the committee, has made an outstanding contribution to the science and art of gardening."

DR. BRADFORD WILLARD, since 1939 head of the department of geology at Lehigh University, was chosen at the York meeting president-elect of the Pennsylvania Academy of Sciences.

DEAN A. W. BRYAN, of the Dental College of the University of Iowa, has been elected president of the American Association of Dental Schools.

MRS. ELEANOR BROWN MERRILL, executive director of the National Society for the Prevention of Blindness, has been elected president of the National Health Council for 1944 to succeed Dr. George S. Stevenson, medical director of the National Committee for Mental Hygiene.

DR. HARRY BENJAMIN VAN DYKE, head of the division of pharmacology of the Squibb Institute for Medical Research at New Brunswick, N. J., has been appointed professor of pharmacology at Columbia University and executive officer of the department. He succeeds Professor Charles C. Lieb, who retires to become Hosack professor of pharmacology, emeritus.

ALDEN R. WINTER, on leave from the Ohio State University, will serve for nine months as research associate professor of poultry husbandry at the Iowa State College. He will make a study of the bacteriological and pasteurization problems of egg products.

DR. CHARLES E. DECKER, professor of paleontology

and head of the department of the University of Oklahoma, and J. Reed Nielsen, professor of physics, have been elected to research professorships. These chairs were established at a meeting of the Board of Regents on November 12. They are awarded to members of the faculty who shall have made distinguished contribution to knowledge and who have demonstrated vigorous leadership in the field. Each will receive a salary of $5,000 a year for a ten-months period. Nominations are made to the Graduate Council by the dean of the Graduate College. On the unanimous vote of the council the dean submits a list to the president for approval and the subsequent approval of the Board of Regents. It is provided that "the tenure of the professor shall be until he reaches the statutory retirement age established by the regents."

DR. ALFRED LE ROY JOHNSON, orthodontist, professor of clinical dentistry, has been appointed administrative officer of the new School of Dental Medicine of Harvard University and associate dean of the faculty of medicine. The School of Dental Medicine on March 31 assumed responsibility for all dental education and research at the university. It succeeds the Harvard Dental School, the oldest university dental school in the United States, which was founded in 1867 and which held its final commencement last month. Its quarters will be rearranged for the new school.

WALTER FITZGERALD, senior lecturer in geography at the University of Manchester, has been appointed professor of geography in succession to Professor H. J. Fleure, who will retire in September.

DR. GEORGE K. STRODE, since 1938 associate director of the International Health Division of the Rockefeller Foundation, has been appointed director, effective on September 1. He will succeed Dr. Wilbur A. Sawyer, who plans to retire.

DR. ALFRED M. LUCAS has resigned as associate professor of zoology at Iowa State College to become cytopathologist at the U. S. Regional Poultry Research Laboratory, East Lansing, Mich.

DR. V. N. KRIVOBOK, recently chief metallurgist of Lockheed Aircraft Corporation, has joined the development and research division of the International Nickel Company in New York. Dr. Krivobok was from 1924 to 1940 connected with the Carnegie Institute of Technology, Pittsburgh, becoming professor of metallurgy there in 1932.

DR. R. E. STRADLING has been appointed to the newly established position of chief scientific adviser to the British Ministry of Works. He will retain his post of chief adviser in research and experiments to the Ministry of Home Security.

SIR HENRY DALE, president of the Royal Society, London, has accepted an invitation of the British Penicillin Committee to be their chairman. The other members of the committee are Dr. V. D. Allison, Ministry of Health; Lieutenant-Colonel H. J. Bensted, Army Medical Department, War Office; Professor R. V. Christie, Medical Research Council; Dr. A. N. Drury, Medical Research Council; Professor A. Fleming, St. Mary's Hospital; Professor H. W. Florey, School of Pathology, Oxford; Dr. C. R. Harington, Medical Research Council; Professor I. M. Heilbron, professor of organic chemistry, Imperial College of Science and Technology, and scientific adviser to the Ministry of Production; Professor R. P. Linstead, department director of scientific research, Ministry of Supply; Professor H. Raistrick, London School of Hygiene; Professor Sir Robert Robinson, Dyson Perrins Laboratory, Oxford; and Colonel Sir Russell Wilkinson, military medical adviser, Ministry of Supply, together with representatives of firms engaged in the production of penicillin.

DR. E. DEGOLYER, who recently resigned from the Petroleum Reserves Corps, after investigating for the Government the oil resources in Saudi Arabia, has accepted an invitation from the Brazilian Government to explore petroleum potentialities there.

ARTHUR PHILLIPS, professor of metallurgy at Yale University, will leave in May to spend three months in São Paulo, Brazil, where he will deliver a series of lectures on non-ferrous metallurgy. He is one of four United States authorities in metallurgy to lecture in the series established last year at the Escola Politecnica of the University of São Paulo and at the Instituto de Pesquisas Tecnologicas, also of São Paulo. The project is jointly financed through the office of the Coordinator of Inter-American Affairs and the University of São Paulo, and is administered by the Stevens Institute of Technology. Mr. Phillips has been invited to visit many of the metal industries in order to gain an intimate knowledge of the problems facing the metal producers of Brazil.

DR. SELIG HECHT, of the Laboratory Biophysics of Columbia University, gave on March 28 a lecture on "Energy and Vision" under the auspices of the Harvard University Chapter of the Society of the Sigma Xi.

THE third Edwin R. Kretschmer Memorial Lecture of the Institute of Medicine of Chicago will be delivered at the Palmer House on Friday evening, April 28, by Dr. Russell L. Haden, of the Cleveland Clinic, on "The Varying Clinical Picture of Leukemia."

THE Gehrmann Lectures for 1943–1944 will be delivered at the University of Illinois College of Medicine

on May 17, 18 and 19 by Dr. Harold S. Diehl, dean of the Medical Sciences at the University of Minnesota. He will speak on the cause, epidemiology, prevention and treatment of the common cold, and on some recent American epidemics.

DR. EARL A. EVANS, JR., professor of biochemistry at the University of Chicago, will deliver the seventh Harvey Society Lecture of the current series at the New York Academy of Medicine on April 20. He will speak on "Carbon Dioxide Fixation in Animal Tissues."

DR. COLIN M. MACLEOD, professor of bacteriology at the New York University College of Medicine, delivered the Laity Lecture at the New York Academy of Medicine on March 23. His subject was "The Past, Present and Future of Chemotherapy."

DR. LEON H. LEONIAN, of West Virginia University, spoke on March 22 to the Eastern Missouri Branch of the Society of American Bacteriologists and the department of botany of Washington University on the "Comparative Value of the Different Test Organisms in Microbiological Assay of B Vitamins."

THE Medical Branch at Galveston of the University of Texas has established an annual lectureship under the auspices of the Phi Beta Pi Medical Fraternity. The first lecture in the series was given on March 25 by Dr. Theophilus S. Painter, research professor of zoology at the University of Texas. It was entitled "A Cytologist Looks Forward."

THE Council of the Association of Southeastern Biologists has voted not to hold it annual meeting this spring due to the war emergency. It was decided also that the incumbent officers would serve until the next annual meeting. These officers are: *President,* Mary Stuart MacDougall; *President-elect,* Dr. James T. Penney; *Vice-president,* Dr. Reed O. Christenson, and *Secretary-Treasurer,* Dr. Martin D. Young.

THE American Home Economics Association will hold its annual meeting from June 20 to 23 in Chicago, with headquarters at the Stevens Hotel. The program will be devoted to a discussion of "The Family in the World of To-morrow." A Youth Conference for members of the home economics student clubs affiliated with the association will be held during the same week.

ACCORDING to the daily press, Louis Bamberger, founder of L. Bamberger and Company, the Newark department store, who died on March 11, left his residuary estate to the Institute for Advanced Study at Princeton, N. J., which he founded with his sister, Mrs. Felix Fuld, in 1930 with a gift of $5,000,000. It is estimated that the residuary estate will amount to over $1,000,000.

THE New York Medical College has received a grant of $30,000 from the Anaconda Wire and Cable Company for research in industrial medicine, arising out of problems incident to the manufacture of its products. The study will determine whether occupational hazards exist and will develop means of giving adequate protection to the workers if necessary. The project is under the direction of Dr. Lindsley F. Cocheu, director of the department of public health and industrial medicine, assisted by Dr. Linn J. Boyd, director of the department of medicine, and Dr. Francis J. Speer, director of the laboratories of clinical pathology.

THE Pittsfield Building in Chicago and the Loop site it occupies, together with 10,000 shares of Marshall Field and Company Series 1–6 per cent. preferred stock, have been transferred to the ownership of the Chicago Natural History Museum (formerly Field Museum) as a gift from Marshall Field, publisher of *The Chicago Sun* and member of the board of trustees of the museum. The contribution is in fulfilment of a pledge made by Marshall Field on September 15 on the occasion of the celebration of the fiftieth anniversary of the museum, when he authorized Stanley Field, president of the museum, to make public his intention to give the museum "certain pieces of property that should produce an income at least equivalent to what his annual contributions have been in recent years."

THE U. S. Weather Bureau will offer twenty full tuition scholarships in the department of meteorology of the College of Engineering of New York University to train women and discharged veterans for positions in Weather Bureau offices in various parts of the United States. Applicants must have had at least two years of college work, including physics and mathematics through calculus. The course at New York University will be similar to that given to Army Air Cadets and Naval Ensigns, and will extend from May 5 to January 10. An intensive one-month refresher course in mathematics and physics is offered to applicants during April. Students who successfully complete the course will be eligible for civil service examinations for positions with a base salary of from $1,800 plus 20 per cent. to $2,000 plus 20 per cent.

THE Ohio State University announces the establishment of the Edward L. Bernays Radio Award of $1,000, a gift from Mr. Bernays, of the Public Relations Counsel, New York, to the Institute for Education by Radio of the university. It is provided that the award shall go to the individual "who makes the outstanding contribution in the year 1944 in the field of radio which furthers democratic understanding, democratic thinking and democratic action by the people of the United States."

# DISCUSSION

## THE USE OF AN INTERNATIONALLY UNDERSTANDABLE LANGUAGE IN SCIENTIFIC PUBLICATIONS AND IN CONGRESSES

ONE of the main facts impending on the normal development of all branches of scientific life is the utilization of numerous different idioms for the publication of research works. In Europe alone about twenty-five native languages compete in scientific publications; in Asia there are fewer at present, but their number will probably increase in the way of including new populations of that big continent into the circle of cultural progress.

A partial solution for the urgent problem of international linguistic understanding between scientists has been found in the insertion of short summaries written in one of the leading languages giving a résumé of the contribution of the author in his national idiom.

A further step has been made by specialized magazines and by sections in scientific journals which give information in condensed reports about all scientific publications of the world.

In international meetings the question is resolved by translators, who generally give short abstracts—and only rarely complete reports—about the works presented. These mentioned "solutions" represent a valuable contribution to the interchange of scientific problems, but they must be considered as palliative methods. As a matter of fact no "summary" and no "abstract" can reproduce exactly important details of determined reports.

From the point of view of the rationalization of valuable human energy it is obvious that this situation is the origin of an enormous waste of intellectual and material efforts, conditioned by a superfluous repetition of the same experiences and researches in various countries. The progressing intensification and specialization of scientific research work will increasingly complicate the problem of divulgating practical applications of valuable results on a world-wide scale.

There is only one radical remedy susceptible to change this situation described above—the creation of an international language for scientific publications and for research meetings. Everybody knows of the attempts to introduce a universal language. But "Esperanto," the most successful of all, though backed by a high idealistic conception, gave only modest practical results. In my opinion, the proclaimed aim can be realized much sooner if international understanding starts in the field of the scientific research work. Once adapted there the extension of a world-wide understandable idiom to other branches of human life would follow progressively.

As an eventual intermediary language there can be mentioned Latin, one of the so-called living idioms, or an artificial language, such as Esperanto. As a biologist, I am personally more inclined (as certainly also others are), to oppose the introduction of any artificial language rooting in a multitude of native tongues and lacking therefore in the organic development—so well it may be elaborated.

Better founded seems to me the utilization of Latin or of one of the living idioms, specially of the English language. In favor of this thesis the following facts may be remembered: The existence of a complete scientific terminology, the divulgation of the English idiom all over the world and the relative small value of grammatical rules.

As to the use of Latin it may be considered as a favorable fact that this language can not hurt the national feelings of any people.

Naturally each intermediary language can enumerate reasons pro- and contra- its application on an international scale. It seems to be the task of an International Commission, composed of representatives of the theoretic and of the practical science branches, to weigh out the advantages and disadvantages of each of the proposals presented.

If I consider as advisable to present by an intermediary language scientific publications, reports of the activity of scientific societies, discussions on international meetings, I include the right for each participant nation of orientating as before scientific writing in their respective national idioms.

The translation of standard works—as in the chemical branch, "Beilstein, Handbuch der organischen Verbindungen"—remains in charge of this International Commission, which has to be divided into sections corresponding to the various branches of scientific life. Special international agreements have to assure the adequate interpretation of the copyright law. A further task of this institution should be to establish a uniform scientific nomenclature.

The object of the present contribution is to suggest that the American Association for the Advancement of Science may take up this problem as a matter of discussion. The present circumstances seem to favor the elaboration of preliminary bases of an international scientific language, for the moment nears when all human beings can newly contribute to the construction of a better world. No doubt the utilization of an idiom understandable all over the world would represent a valuable contribution of science to the

establishment of better relations between all nations and constitute a real progress of our civilization.

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UNIVERSITY OF SÃO PAULO, BRAZIL

## THE NATURAL SCIENCE SOCIETY OF CHINA[1]

THE following letter, dated January 24, has been addressed to the American Association for the Advancement of Science:

We learned with great admiration and pride the splendid part the members of your Academy have played in the present war against fascism and barbarism. Our country and especially the cultural institutions have suffered deliberate and wanton destructions from the hands of the Japanese fascists during the present invasion. In spite of this, we are endeavoring to do our best to serve our country and the noble cause of our allies with the meager equipments and literature that were left to us. We sincerely believe that science and democracy are indispensable in our modern world, but science without democracy means fascism and Hitlerism and democracy could not function efficiently and smoothly without scientific knowledge and the scientific means of production to satisfy the cultural and material needs of the masses. We further believe that the cooperation and collaboration of the scientific workers of the world will help us to gain a quick victory and will also facilitate the laying down of the foundation of permanent peace immediately after the war. In order to do our modest part towards the goal of international scientific cooperation we have compiled a paper called "Acta Brevia Sinensia" in which the research activities and the recent news of the various institutions of our country are reported at definite intervals, and at the same time we are preparing to issue another paper, the main purpose of which is to print scientific news and abstracts of scientific papers of our allies. In order to make it a success we, therefore, beg your kind cooperation, and hoping you would kindly supply us the scientific news and abstracts of papers of your country.

Enclosed herewith is a copy of a short account of our society and our activities. As we are late comers in the realm of science and technology we should be very thankful if you would kindly favor us with your words of wisdom.

May this letter serve as a messenger boy to bring to you our hearty greetings and warmest congratulations for the patriotic works so wonderfully performed in the present struggle against the enemy of science and humanity.

With New Year's greetings,

CHANG-WANG TU,
(*Secretary for Foreign Relations*)

An account is enclosed giving a list of the activities of the society, which reads:

1. *History and Aims:*

The society was established in 1927 with a view to achieve the following: (*a*) to spread scientific knowledge to the masses; (*b*) to apply scientific and technological knowledge to national reconstruction; (*c*) to promote scientific research; (*d*) to facilitate scientific cooperation.

2. *Organization:*

There are thirteen branch societies established in various districts of free China and three additional ones in Europe and America. The members of the society total 1,800. Under the head office at Chungking there are four committees: (*a*) Committee for General Affairs; (*b*) Committee for Research and Culture; (*c*) Committee for Organization; (*d*) Committee for Social Service.

3. *Activities:*

The following works of importance have been carried out by the society since its establishment:

(*a*) The publication of the *Scientific World.* Twelve volumes have been issued since 1932. This magazine is a very popular scientific journal in China.

(*b*) The organization of scientific expeditions. Since 1937 two scientific expeditions have been sent out by the society to explore the natural resources, to study the physical and bio-geography of provinces such as Sikang, Kansu and Ningsha. The results of these expeditions are contained in the reports published afterwards.

(*c*) The publishing of scientific books concerning the problems of national defense. The following books are already in press: i. "On the Principles of Flight"; ii. "Principles of Aeroplane Construction"; iii. "Explosives"; iv. "Precaution Against Poisonous Gases"; v. "Ballistics." In addition, there are some twenty volumes under preparation.

(*d*) Public lectures and radio talks on science. Public lectures and radio talks on scientific subjects have been given periodically to the public in various cities of China.

(*e*) The publication of "Acta Brevia Sinensia." This paper intends to convey the scientific works done in China to the scientific workers of the democratic world. The society is planning to publish a bulletin to print the scientific news and achievements of our allies with the cooperation of the leading scientific societies of the democratic world.

(*f*) Future projects. The members of the society feel that they should devote more time to the society and the masses, so plans have been drawn accordingly. The more important ones will be carried out as soon as we have the money, and they are: (i) to establish a "Science Museum" and a "Science Library"; (ii) to organize an institute for scientific service; (iii) to publish a journal for original research work, etc.

NATIONAL CENTRAL UNIVERSITY,
SA-PING-PA, CHUNGKING, CHINA

[1] Transmitted by the China Section of the Science, Education and Art Division of The Department of State, March 1, 1944. Translated from the official letter in Chinese.

## SOVIET BIOLOGY

THE eulogy of Soviet biology published in a recent issue of SCIENCE[1] did not present a realistic survey of the present situation. The author did not discuss the most significant trend of biological research in the

[1] L. C. Dunn, SCIENCE, January 28, 1944.

U.S.S.R.—the subservience of science to social and political philosophy. It is important that this aspect of Soviet science should be generally known and understood because it is not confined to Russia. It could happen here.

The work of Russian geneticists, plant breeders and cytologists, during the early years of the Soviet régime, deserves the highest praise, as does the Soviet government for providing such generous support for scientific work. About ten years ago the influence of Soviet political philosophy began to appear in biological science, culminating in a public controversy regarding the relative roles of environment and heredity in 1939. Much of this controversy has been published in this country,[2] and a more damning indictment of the new Russian biology would be difficult to imagine. Vavilov, while recognizing the effect of environment on development, emphasized the progress of genetics and the role of heredity in plant breeding. Lysenko, on the other hand, upheld the Lamarckian (in his words "Darwinian") concept of variation, and rejected Mendelian heredity and genetics as a science. He also claimed that "any hereditary properties can be transmitted from one breed to another without the immediate transmission of the chromosomes." His discussion of "vegetative hybrids" resulting from grafting might well have been written in 1800; his views are neither original nor heterodox, but merely archaic.

Lysenko's attitude towards genetics presumably was influenced by his earlier work on vernalization. A winter wheat, which differs from a spring wheat by a single genetic factor, can be grown as a spring wheat if the seed is moistened and chilled for several weeks before planting. This discovery was made in the United States before the Civil War. Vernalization is also said to hasten the maturity of other crops. This technique has been tried in many other countries without sufficient success to warrant commercial utilization, but it has been used extensively in Russia.

Lysenko and his associates seem to have convinced the political authorities that only environmental effects are of value in plant improvement. Since 1939 the Soviet plant-breeding journals have been filled with articles by Lysenko's disciples, but we hear nothing from Vavilov, Karpechenko, Navaschin and the many other able scientists who are responsible for building the foundations for Russia's plant-breeding program. A few examples of the recent plant-breeding methods are typical of the new order. In one case scions of a yellow-fruited tomato variety when grafted on a red-fruited stock are said to produce progeny segregating for fruit color. Dolgusin claims that halves of the same plant, when grown under different environmental conditions and then crossed, produce progeny of increased vigor and fertility. The ovules are supposed to select the pollen grains most favorably affected by the environment. This selective power of the gametes is referred to by Lysenko as "marriage for love."

There are several reasons for the suppression of genetics in the U.S.S.R. A nationalistic attitude is reflected in Polyakov's[2] reference to genetics as a "foreign science." Another factor may have been a reaction to the distortion of genetic principles by the Nazis in their myth of racial superiority. The primary factor, however, appears to have been based upon political philosophy. It is particularly significant that the Lysenko-Vavilov controversy was reviewed by Mitin, head of the Philosophical Institute of the Academy of Science, and that he "more than other commentators" expressed "the attitude of the Soviet government."[2]

Our admiration for the Russian people and the military might of the Soviet Republic should not blind us to the fact that science has not been free in the totalitarian states where science must conform to political philosophy.

KARL SAX

HARVARD UNIVERSITY

## NEWTON ON HEAT AS A MODE OF MOTION

IN reading lately Query 28 in Newton's "Opticks," I noticed a remark that gives his views on the nature of heat. It was new to me, and perhaps it will be interesting to other physicists. The passage in part is as follows: "A dense fluid can be of no use in explaining the phenomena of Nature, the motion of planets and comets being better explained without it. It serves only to disturb and retard the motions of those great bodies, and make the frame of nature languish: and in the pores of bodies, it serves only to stop the vibrating motions of their parts, wherein their heat and activity consists."

FRANK ALLEN

UNIVERSITY OF MANITOBA

# SCIENTIFIC BOOKS

## THE PLASMODIOPHORALES

*The Plasmodiophorales.* By JOHN S. KARLING. ix + 144 pp. 17 plates, 11 text figures. Published by the author. New York. 1942.

THIS book is based upon a "series of lectures presented to graduate and research students of mycology at Columbia University." Accordingly, the author attempts to present all sides of controversial questions

[2] *Science and Society.* A Marxian Quarterly. Summer, 1940.

with extensive references to the works of various investigators in the field. He points out obvious errors and misinterpretations of observations, but in cases of doubt leaves it to the reader to decide what conclusions he should draw from the reported facts. Constantly the author points out where further investigations are necessary before the final decisions can be made. This group of organisms is regarded as consisting of but one family, the Plasmodiophoraceae, with eight or perhaps nine valid genera and twenty-three species, besides possibly four genera doubtfully belonging to this family each with a single species. Four genera that have been ascribed to the group are definitely excluded as are a number of species from the accepted genera. *Woronina* of Family Woroninaceae is discussed, but for the present is left in that family until further cytological studies may cause it to be transferred to the Plasmodiophoraceae.

A chapter is devoted to the cytology of the Plasmodiophorales in comparison with that of various Protozoa. The reported phenomena are so contradictory that it seems unwise to base decisions as to relationship on cytology until there is better agreement as to the presence or absence of "promitosis," "wheel type" of resting nucleus, "saturn" stage, "akaryote" stage, type and location of meiosis, "schizogony," etc. Another chapter is devoted to "Sexuality and Alternation of Generations." Here, again, the disagreements are more pronounced than the agreements. In some species sexual union of cells is unknown; in *Plasmodiophora brassicae,* the longest known and most intensively studied species of the family, sexual union has been reported outside of the host tissues, early after entry into the host and close to the end of the life cycle just before the resting spores are formed. In general the more typical life history in the family is as follows: The resting spore germinates to set free an anteriorly biflagellate heterocont zoospore. This infects the host cell and with or without further cleavage becomes, by growth accompanied with mitotic division of the nuclei, a multinucleate plasmodium. This cleaves into uninucleate segments, each of which is invested with a thin wall and becomes a zoosporangium whose zoospores are similar to, but sometimes smaller than, those produced by the germination of the resting spores. These reinfect other cells of the host and produce plasmodia which eventually cleave into resting spores. Cytogamy and karyogamy are described by some authors between the products of the resting spores, by some between the zoospores emerging from the zoosporangia, while karyogamy followed by meiosis is claimed by still others as occurring in the nearly mature plasmodium just before it breaks up into the resting spores.

Chapter IV takes up the "Classification and Description of Species." In the main the author follows Schroeter's arrangement with full recognition of its faults and artificiality. Until satisfactory life history studies have been completed in all the genera these undesirable conditions must remain. The first genus to be described was *Plasmodiophora* by Woronin, in 1877, and the last genus to be proposed was *Octomyxa* in 1939. With the exception of *Ligniera* and of *Polymyxa* all known species of the family cause hypertrophy and often hyperplasy of the host tissues. With the exception of *Octomyxa achlyae,* which is parasitic in *Achlya glomerata,* and of *Sorodiscus karlingii,* parasitic in *Chara,* the species are found in the roots and stems of vascular plants. The production of zoosporangia in the life history of the organism has been demonstrated for *Plasmodiophora, Octomyxa, Sorosphaera, Spongospora, Ligniera* and *Polymyxa.* It has not been recorded in *Tetramyxa, Sorodiscus* and in *Membranosorus* whose status as an independent genus is uncertain. Indeed, according to Palm and Burke, the validity of many of these genera is very doubtful. Their distinction is based on the manner of clustering or separation of the resting spores at maturity, and this appears to vary considerably in the same species.

All the genera and most of the species are illustrated by redrawings from the original publications, as are also the doubtful and the excluded genera.

Chapter V discusses the "Phylogeny and Relationship of the Plasmodiophorales," especially with reference to their possible relationship to the Myxomycetes or to the Chytridiales or to the Proteomyxa and other Protozoa. The author gives a very fair discussion of the various claims that have been proposed by various authors.

The final chapter discusses the two diseases of cultivated plants that are of economic importance: Clubroot of cabbage and other Crucifers, caused by *Plasmodiophora brassicae,* and powdery scab of potatoes, caused by *Spongospora subterranea.* The known hosts are listed, the types of lesions and damage are described, the resistance and susceptibility of different host varieties and the geographical distribution are discussed rather fully. The methods of control are given considerable space. A rather complete bibliography completes this chapter.

The book is unfortunately marred by rather numerous typographical errors, a few of spelling but most of incorrect dates, page and figure references, etc. The appearance is that of extreme haste in the proofreading. In spite of this minor annoying feature the student of the Plasmodiophorales and related groups will find in this book a mine of information which will

save him a tremendous amount of searching the literature, which is, in many cases, rather inaccessible. He will have the main facts before him even on controversial points and will know where further research is necessary. He will perforce have to draw his own conclusions on many things, so fairly have the various sides of the subject been presented. This is perhaps the greatest compliment that a book of this type can receive.

ERNST A. BESSEY

DEPARTMENT OF BOTANY,
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## INORGANIC CHEMISTRY

*A Textbook of Inorganic Chemistry.* By FRITZ EPHRAIM. English edition by P. C. L. THORNE and E. R. ROBERTS. Fourth edition, revised and enlarged. 921 pp. New York: Interscience Publishers, Inc. $8.75. London: Gurney and Jackson. 28 shillings net. 1943.

THIS well-known text now appears in a fourth edition with only minor revisions and the addition of a dozen pages of new material. The recent work on radioactivity and isotopes has been included and descriptions of new compounds and reactions have been given. The progress in the field of artificial radioactivity is so swift that the discussion (p. 90) on nuclear fission, while it reflects opinion in 1940, does not correspond with the judgment of 1943 concerning the possibility of an era of atomic energy, which now appears not too far distant.

The outstanding advantage of this text is that it presents the field of inorganic chemistry in all its varied aspects from a consistent logical standpoint with a mode of presentation which departs refreshingly from the multitudes of inorganic chemical texts that have been written around a single traditional pattern. Ephraim's text is exactly suited to the senior student who wishes to refresh and refurnish his mind concerning basic inorganic chemistry in preparation for advanced examinations. It should be required reading for all professors of general chemistry, the exercise to be repeated as each new edition appears. The English editors deserve our best thanks for continuing to make this text accessible a decade after the original author's death and for their care in compilation and revision.

HUGH S. TAYLOR

# REPORTS

## THE AWARD OF GUGGENHEIM FELLOWSHIPS FOR 1944

THE sum of $200,000 has been appropriated this year by the John Simon Guggenheim Memorial Foundation for fellowships exclusively for men and women who are serving the nation in the war effort, in addition to sixty-nine fellowships with stipends of $155,000 to Americans and Canadians to assist their work of scholarship and artistic creation. All the fellowships are awarded, in wartime, subject to any national service to which the recipients may be called; but if any fellow is called into such service the foundation will make his fellowship available to him when he receives his discharge.

The appropriation of $200,000 for post-service fellowships is in addition to the usual budget. These funds will be used to grant fellowships to young scholars and artists who are serving the nation in the armed and other governmental services, including those doing war research under contracts made by the Office for Scientific Research and Development and similar agencies. They will be granted upon the same basis as the other fellowships, to persons who have demonstrated unusual capacity for research and artistic creation. They will be granted before the end of the war and will be made available to the recipients as soon as they are discharged from service. Five such fellowships have been awarded. They include one to Joseph Hickey, ornithologist, engaged upon war research at the University of Chicago. Mr. Hickey, who is the author of "A Guide to Bird Watching," proposes to make an analysis of approximately 250,000 records of banded birds to learn their life expectancies in the wild, their population turnover in nature and other facts of value to conservationists, and the mapping and charting of migration routes, especially for those species that are becoming endangered by civilization.

Awards of fellowships for the year 1944–45 include in the sciences:

DR. T. C. SCHNEIRLA, associate professor of psychology, New York University, and associate curator of animal behavior, the American Museum of Natural History, New York City: A study of the relationship between instinct and learning in insect psychology. The work will be based chiefly on his study of the behavior of army ants on the Isthmus of Tehuantepec, Mexico.

DR. R. A. STIRTON, lecturer and curator of fossil mammals, Museum of Paleontology, University of California at Berkeley: Exploration for fossil vertebrates in the Panamanian region of South America to obtain evidence concerning the date and position of water barriers between the American continents in prehistoric times.

DR. AARON J. SHARP, associate professor of botany, University of Tennessee: A study of the plants common to the Southern Appalachians and the temperate floras of the mountains and highlands of Mexico and Central America.

DR. BASSETT MAGUIRE, curator in the New York Botanical Garden, Bronx Park, New York City: Exploration for unknown plants in the interior rain-forest and savannah lands of Dutch Guiana and along the lower Amazon River.

The origins of corn and tomatoes, food plants indigenous to the Western Hemisphere, will be studied by two fellows in Latin America:

DR. PAUL WEATHERWAX, professor of botany, Indiana University, will go to the highlands of Peru and Bolivia, one of the great pre-Columbian centers of agriculture, where corn may have been domesticated.

DR. JAMES ANGUS JENKINS, assistant professor of genetics, University of California at Berkeley, will work in the state of Jalisco, Mexico, on a genetic analysis of varietal differences in cultivated tomatoes.

Fellowships for work in the biological sciences are more numerous than those granted for work in any other field this year:

DR. C. B. VAN NIEL, professor of marine biology, Stanford University, Hopkins Marine Station, Pacific Grove, Calif.: Studies of the new concepts of chemical and physical phenomena with a view to applications in general biochemistry.

DR. FRANK H. JOHNSON, assistant professor in biology, Princeton University: Studies of the fundamental mechanisms that control biological processes and phenomena.

DR. JANET R. MCCARTER, assistant professor, department of agricultural bacteriology, University of Wisconsin: Studies in the field of immunology of infectious diseases, in particular observations on the aerological and biological activities of tuberculo-proteins.

DR. VALY MENKIN, associate in research, Fearing Research Laboratory, Free Hospital for Women, Brookline, Mass.: Studies of the chemical basis of inflammation in wounds.

DR. JOHANNES F. K. HOLTFRETER, Rockefeller Foundation fellow at McGill University, Montreal: Investigations of the causal factors involved in the embryonic development of vertebrates. Dr. Holtfreter is one of the world's leading experimental geneticists. He is of German origin, and was sent from England to an internment camp in Canada, from which he was released upon the appeal of Canadian scholars who admire his work and have the highest esteem for him personally. For the past two years he has worked at McGill University as the guest of the university and under the auspices of the Rockefeller Foundation.

DR. EMMA LUCY BRAUN, associate professor of plant ecology, University of Cincinnati: Studies of the ecology and taxonomy of the deciduous forest.

DR. GEORGE NEVILLE JONES, associate botanist, University of Illinois, Urbana: A study of the botany of the Northwest Coast of America.

DR. TILLY EDINGER, research associate in paleontology, Museum of Comparative Zoology, Harvard University: A study of the development of teeth in the evolutionary line leading from ancestral fishes to mammals.

DR. KENNETH W. COOPER, assistant professor of biology, Princeton University: Cytological studies of the pairing of sex chromosomes in the fruit fly.

DR. WILLIAM N. TAKAHASHI, instructor of plant pathology, University of California at Berkeley (on leave, working at Cornell University: Plant virus investigations, from biochemical and physical points of view.

DR. HUDSON HOAGLAND, professor of general physiology, and director of Biological Laboratories, Clark University: A study of the physiology of psychotic patients.

In the field of mathematics Dr. André Weil, assistant professor of mathematics in Lehigh University, Bethlehem, Pa., will prepare a book on the foundation of algebraic geometry.

This is the nineteenth annual series of fellowship awards by the foundation, which was established and endowed by the late U. S. Senator Simon Guggenheim and by Mrs. Guggenheim as a memorial to their son John. The Guggenheim Fellowships are granted to creative workers in all fields who by their previous work have shown themselves to be persons of unusual ability, demonstrated by the previous production of contributions to knowledge or by the production of works of art. Men and women, married and unmarried, of all races and creeds who are citizens or permanent residents of the United States, citizens of Canada and of certain Latin American countries, are eligible on equal terms. The fellows are normally of ages between 25 and 40 years. The stipends are usually $2,500 a year. The fellowships now announced were granted to American and Canadian scholars and creative workers, while a series of fellowships for Latin Americans will be granted in June.

The fellows chosen this year come from twenty-one States and from three Canadian Provinces. Forty-three fellows are members of the staffs of thirty-seven educational institutions, two are in government employment and twenty-four are free-lance workers. Approximately nine hundred applications for the fellowships were presented this year.

The trustees of the foundation, in addition to Mrs. Guggenheim, are Francis H. Brownell, Carroll A. Wilson, Charles D. Hilles, Roger W. Straus, John C. Emison, Medley G. B. Whelpley and Charles Merz. The committee of selection consisted of Dr. Frank Aydelotte, director of the Institute for Advanced Study, *Chairman;* Dr. Florence R. Sabin, of the Rockefeller Institute for Medical Research; Professor Edwin Bidwell Wilson, of the Harvard University School of Public Health; Professor Linus Pauling, of the California Institute of Technology, and Professor Wallace Notestein, of Yale University.

# SPECIAL ARTICLES

## THE EFFECT OF ADRENAL CORTICAL AND PITUITARY ADRENOTROPIC HORMONES ON TRANSPLANTED LEUKEMIA IN RATS

IT has recently been reported that removal of the adrenals greatly increases the susceptibility of rats to a transplanted lymphatic leukemia.[1] This result suggested that adrenal secretions have some inhibitory action on the development of the disease. The present report is based on preliminary tests of adrenal cortical extracts and of pituitary adrenotropic hormone which stimulates the secretion of the adrenal cortex. The experiments were as follows.

Rats from a highly susceptible strain were inoculated intraperitoneally with leukemic cells and some hours later intramuscular injections of a hormone preparation were started.

*Desoxycorticosterone acetate.*[2] This preparation in oil was given daily in .1 cc doses to 33 rats inoculated with leukemia and to 41 rats in the same dosage 3 times a week. Approximately 20 per cent. of these animals did not develop leukemia, while the rate of survival in the 70 control rats was 5.7 per cent.

*Eschatin,* a cortical extract[3] administered in .1 to .2 cc amounts twice a day gave from 20 to 37 per cent. protection against the development of leukemia with the controls showing no survivals.

*Adrenal cortex hormones in oil (Upjohn*[4]). Various doses of this preparation have been tested on 87 inoculated rats. In 3 groups given .05 cc doses (2 rat units) daily the survival rates were 44.4 per cent., 50 per cent. and 60 per cent., while the survival among the controls was less than 5 per cent. There was definite protection when .075 cc was given daily, but larger or smaller doses did not give so definite a result.

*Pituitary adrenotropic hormone.*[5] These results varied somewhat with different lots of the material. Among the 67 treated rats, one group showed as high as 75 per cent. survival. Over 40 per cent. of the whole treated group remained free of the disease, which is a definite effect when compared with the 10 per cent. survival among the 68 controls.

The above studies were made entirely with transplanted leukemia and the action of the hormone was to prevent the development of the disease. It would be entirely unjustifiable on the basis of these observations to predict that the adrenal hormone would be of value in treating either the transplanted or the spontaneous disease. The results have a certain scientific interest in presenting further evidence of hormonal control of the lymphoid system.

JAMES B. MURPHY
ERNEST STURM
THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

[1] J. B. Murphy and E. Sturm, SCIENCE, 98: 568–569, 1943.
[2] Schering Corporation.
[3] Parke, Davis and Company.
[4] The Upjohn Company.
[5] We are indebted to Dr. H. O. Singher, of the Memorial Hospital, New York, for this preparation.

## ADEQUACY OF THE ESSENTIAL AMINO ACIDS FOR GROWTH OF THE RAT

IN a recent article, Albanese and Irby[1] have reported that rats lost weight rapidly on a diet which contained as the chief source of nitrogen the ten essential amino acids plus cystine. The relative amounts of amino acids were the same as in casein and were fed in quantity equal approximately to 14 per cent. of the total diet. When double the proportion of amino acids was fed, three out of six animals died and the remaining three ate poorly until they were sacrificed three weeks later. Despite the losses in weight, the animals on the 14 per cent. level amino acid diet maintained a positive nitrogen balance. These writers suggested that "the nutritive inadequacy of the essential amino acid diet may be due in part to toxic effects of unnatural forms of certain amino acids that cannot be utilized."

The above findings are not in agreement with results obtained by the present authors who, incidental to some other work, have regularly observed growth on diets containing the ten essential amino acids as the chief source of nitrogen. Also, Rose,[2] without giving the composition of the diets used or growth curves, states that animals fed a simplified diet containing the active amino acids (11.2 per cent.) "gained in weight just as rapidly as when all the protein components were supplied preformed." In view of the desirability of having the issue clarified, we have repeated and amplified our earlier experiments.

It will be noted that Albanese and Irby supplied the B vitamins in the form of yeast. Since the preformed protein components of yeast might alter the amount of growth, we have supplied all the necessary B vitamins in a pure form.

Young, inbred, Sherman strain albino rats were used in all the studies. The diets consisted of the same amino acid-free base[3] and a nitrogenous mixture which was varied in the following manner:

[1] A. H. Albanese and V. Irby, SCIENCE, 98: 286, 1943.
[2] W. C. Rose, *Physiol. Rev.*, 18: 109, 1938.
[3] Amino acid-free base.

| | |
|---|---|
| Cod liver oil | 2 grams |
| Corn oil | 10 grams |
| Salt mixture | 4 grams |
| Thiamin hydrochloride | 224 micrograms |
| Riboflavin | 400 micrograms |
| Pyridoxine hydrochloride | 243 micrograms |
| Calcium pantothenate | 1.5 milligrams |
| Nicotinic acid | 2.5 milligrams |
| Choline chloride | 134 milligrams |
| Para-aminobenzoic acid | 1.0 milligram |

Starch varied to make 100 grams of diet in conjunction with the nitrogenous components.

| *Diet* | *Nitrogenous constituents* |
|---|---|
| 1 | 10 essential amino acids at 5.8 per cent. level[4] |
| 2 | 10 essential amino acids at 11.6 per cent. level |
| 3 | 18 per cent. casein—paired feeding with diet 2 |
| 4 | 10 essential amino acids at 5.8 per cent. level plus 9 per cent. glycine in addition |
| 5 | 18 per cent. casein—paired feeding with diet 4 |
| 6 | 18 per cent. casein—*ad libitum* |

## RESULTS

The lower three curves of Fig. 1 (diet 1) show that rats will grow when the sole source of amino acid nitrogen consists of the ten essential amino acids at a level of 5.8 per cent.; however, as would be expected, they grow slowly. The middle curves (diet 2) show the results of feeding amino acids at double this level, *i.e.*, 11.6 per cent. It will be observed that the additional amount of amino acids considerably increases the growth rate. The nutritive value of this ration appears to be slightly over one half that of an 18 per cent. casein ration. This may be seen by comparing the curves representing animals on diets 2 and 3. The growth on the 11.6 per cent. amino acid mixture was nearly identical with that we have observed in other experiments when rats were fed *ad libitum* diets containing 9 per cent. casein.

The result of supplying additional nitrogen in the form of glycine, in addition to the ten essential amino acids at the 5.8 per cent. level, may be seen from the two lower curves of Fig. 2. The growth rates in these two animals does not appear to differ significantly from those in which the glycine was omitted. The absence of growth in this experiment may be accounted for only partly on the basis of food consumed. The latter may be seen from the growth of rats (diet 5) which were fed a diet containing 18 per cent. casein but in quantities identical with those consumed by the animals on diet 4.

The upper curves of Fig. 2 show the growth rates of rats fed *ad libitum* a diet in which the nitrogen was supplied in the form of casein at an 18 per cent. level. The latter experiment illustrates the adequacy of the base ration and shows that the amino acid content of the other rations represented the limiting factor for growth.

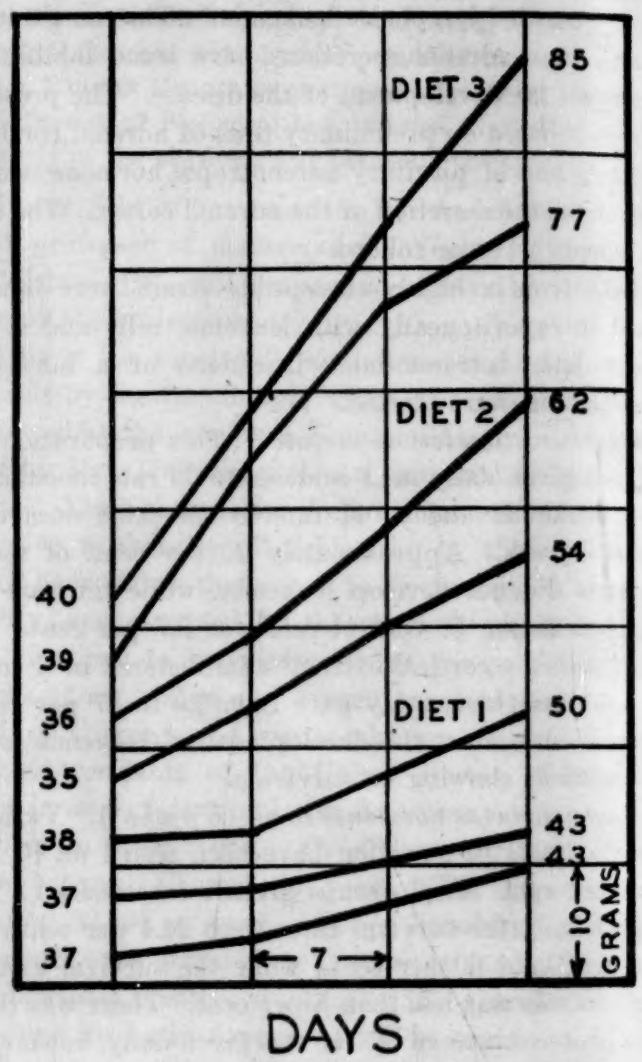


FIG. 1. Growth of rats on diets containing the following as the sole source of nitrogen: Diet 1, 10 essential amino acids at 5.8 per cent. level; Diet 2, 10 essential amino acids at 11.6 per cent. level; Diet 3, 18 per cent. casein—paired feeding with diet 2.

## DISCUSSION

The failure of glycine to augment the growth rate when added to the diet suggests that more than the mere addition of a source of nitrogen is required for good growth, even though the required amounts of the essential amino acids are provided. However, the possibility that glycine in these quantities is toxic has not been eliminated.

In the absence of additional data it is not possible

[4] Proportions of amino acids fed are those given by Rose as the minimal amount of each necessary to support normal growth when the non-essentials are included.

| *Amino acid | Required level of the active form per cent. | Grams per 100 grams of diet as fed, corrected for HCl and inactive enantiomorph |
|---|---|---|
| l(-)arginine mono HCl | 0.2 | 0.242 |
| l(-)histidine mono HCl | 0.4 | 0.494 |
| dl isoleucine | 0.5 | 1.000 |
| l(-)leucine | 0.9 | 0.900 |
| l(-)lysine mono HCl | 1.0 | 1.250 |
| dl methionine | 0.6 | 0.600 |
| dl phenylalanine | 0.7 | 0.700 |
| dl threonine | 0.6 | 1.200 |
| dl tryptophane | 0.2 | 0.200 |
| dl valine | 0.7 | 1.400 |

* All the amino acids used in these experiments were obtained from Merck and Company, Rahway, N. J.

to make a quantitative comparison with Rose's work. In general we have found that at the levels fed, the essential amino acids will give rise to almost as much growth as will an equivalent weight of casein.

We found no evidence of toxicity in spite of using racemic mixtures of six of the amino acids. Without knowing the source of the amino acids used by Albanese and Irby we cannot account for the widely different results obtained. Our findings for rats appear

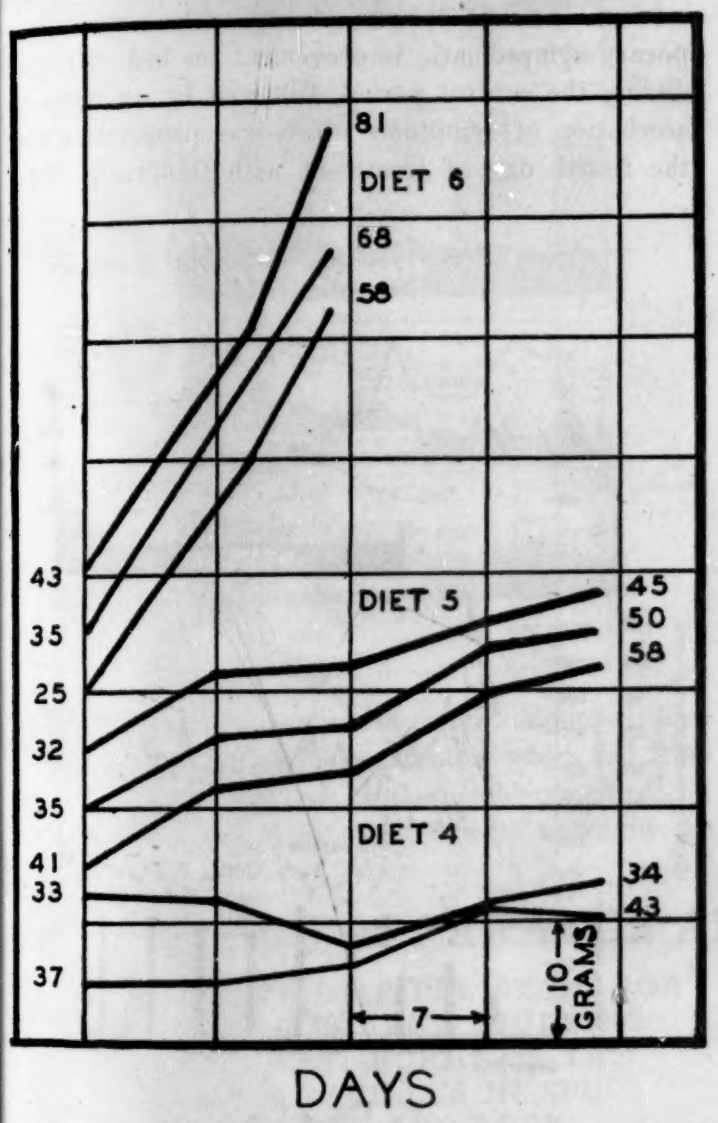


FIG. 2. Growth of rats on diets containing the following as the sole source of nitrogen: Diet 4, 10 essential amino acids at 5.8 per cent. level plus 9 per cent. glycine; Diet 5, 18 per cent. casein—paired feeding with diet 4; Diet 6, 18 per cent. casein—*ad libitum*.

compatible with those obtained in experiments on other animals. For example, Bauer and Berg[5] found slow growth when mice were fed the ten essential amino acids at a 15.6 per cent. level. Furthermore, Madden *et al.*,[6] using dogs, found that plasma protein production after feeding or injecting the essential amino acids was as good as when most proteins were fed in the diet. Moreover, they found no apparent clinical disturbance, even from the rapid injection of the amino acids intravenously.

[5] C. D. Bauer and C. P. Berg, *Jour. Nutr.*, 26: 51, 1943.
[6] S. C. Madden, J. R. Carter, A. A. Kattus, Jr., L. L. Miller and G. H. Whipple, *Jour. Exp. Med.*, 77: 277, 1943.

SUMMARY

Growth was obtained in rats on synthetic diets in which the ten essential amino acids were the sole source of amino acid nitrogen. The growth rate was dependent upon the quantity of amino acids fed and appeared to compare favorably with that obtained when a similar quantity of nitrogen was fed in the form of casein. No increase in growth was observed when nitrogen in addition to that given in the form of the essential amino acids was supplied as glycine. Our experiments would not support the contention that the unnatural forms of the amino acids are toxic.

We wish to acknowledge and thank Phyllis Robison for technical assistance, and Dr. D. Mark Hegsted for helpful suggestions.

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## METABOLIC EFFECTS OF THIOURACIL IN GRAVES' DISEASE[1, 2]

EARLY in 1943, Astwood[3] introduced a new type of therapy for Graves' disease. This was based on the goitrogenic effects of sulfonamides and certain derivatives of thiourea as demonstrated in animals by studies of the MacKenzies and McCollum[4, 5] and of Astwood and co-workers.[6] A systematic investigation of such compounds[7] showed thiouracil to be the most potent and least toxic and led to its selection for clinical trial by Astwood[8] and by Williams and Bissell[8] and others.[9] The mode of action of these drugs appears to be an interference with the enzymatic synthesis of thyroid hormone. The exact point of block is still not known, but it is definitely established that the thyroid gland is rendered incapable of utilizing iodine for this process. The resultant thyroid insufficiency leads, via anterior pituitary stimulation, to an ineffectual hyperplasia of the thyroid acinar cells. The peripheral action of administered thyroid hormone, however, remains unimpaired.

[1] From the Russell Sage Institute of Pathology in affiliation with the New York Hospital and the Department of Medicine, Cornell University Medical College.
[2] With the technical assistance of Vincent A. Toscani.
[3] Astwood, *Jour. Am. Med. Asn.*, 122: 78, 1943.
[4] MacKenzie, MacKenzie and McCollum, SCIENCE, 94: 518, 1941.
[5] MacKenzie and MacKenzie, *Endocrinol.*, 32: 185, 1943.
[6] Astwood, Sullivan, Bissell and Tyslowitz, *ibid.*, 32: 210, 1943.
[7] Astwood, *Jour. Pharmacol. and Exp. Therap.*, 78: 79, 1943.
[8] Williams and Bissell, SCIENCE, 98: 156, 1943; *New Eng. Jour. Med.*, 229: 3, July, 1943.
[9] Himsworth, *Lancet*, 245: 483, 1943.

Clinical reports to date[1, 6] on the use of thiouracil (and to a lesser extent, thiourea[7]) in Graves' disease have shown that this drug has a similar action in man; there is a decrease in the basal metabolic rate and in the protein-bound iodine of plasma, an increase in serum cholesterol and body weight and a disappearance of the symptoms of Graves' disease. No improvement in exophthalmos has been noted; and the effect on the size of the gland has been variable. Toxic reactions have been few, the most notable being a non-fatal agranulocytosis.

It would reinforce the value of thiouracil for the treatment of Graves' disease were the beneficial effects noted above also accompanied by the correction of other metabolic derangements characteristic of this condition, such as is achieved by successful thyroidectomy or iodine remission. With this in mind, a series of patients with Graves' disease are being subjected to detailed metabolic study in the metabolism ward of the Department of Medicine at the New York Hospital. They are placed on constant creatin-creatinine free diets and observations made of the influence of thiouracil on the disturbances in creatin, creatinine, calcium, phosphorus and nitrogen metabolism, as well as on several other indices of thyroid activity. In this preliminary report, the data on one such case are presented in detail in graphic form.

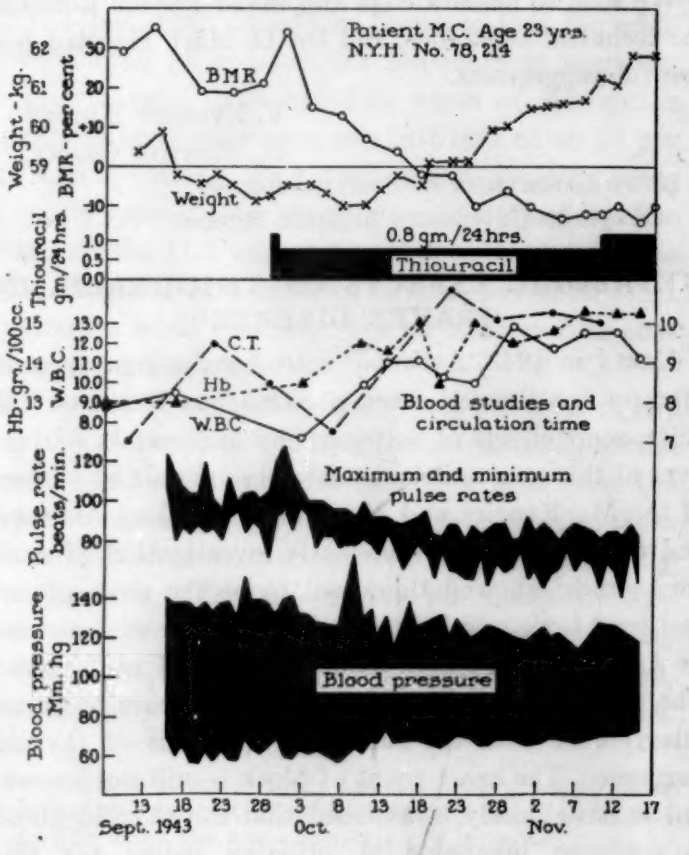


FIG. 1

The patient was a 23-year-old white girl with typical signs and symptoms of Graves' disease of moderate severity and of two years' duration, uncomplicated except for moderate exophthalmos. The gland was moderately enlarged. Balance studies were carried on for two weeks prior to, and for fifty days during the administration of thiouracil. The constant creatin-creatinine free diet provided 2,400 calories, 76 gm protein, 107 gm fat, 283 gm carbohydrate, 1.19 gm calcium and 1.41 gm phosphorus. There was a temporary symptomatic improvement on bed rest alone during the control period, followed by an acute exacerbation of symptoms which was progressive until the fourth day of treatment with thiouracil. From that time on, improvement was rapid and striking in almost all respects. The symptomatic relief was accompanied by an improvement in all the metabolic functions studied, the details of which are given in Figs. 1, 2 and 3.

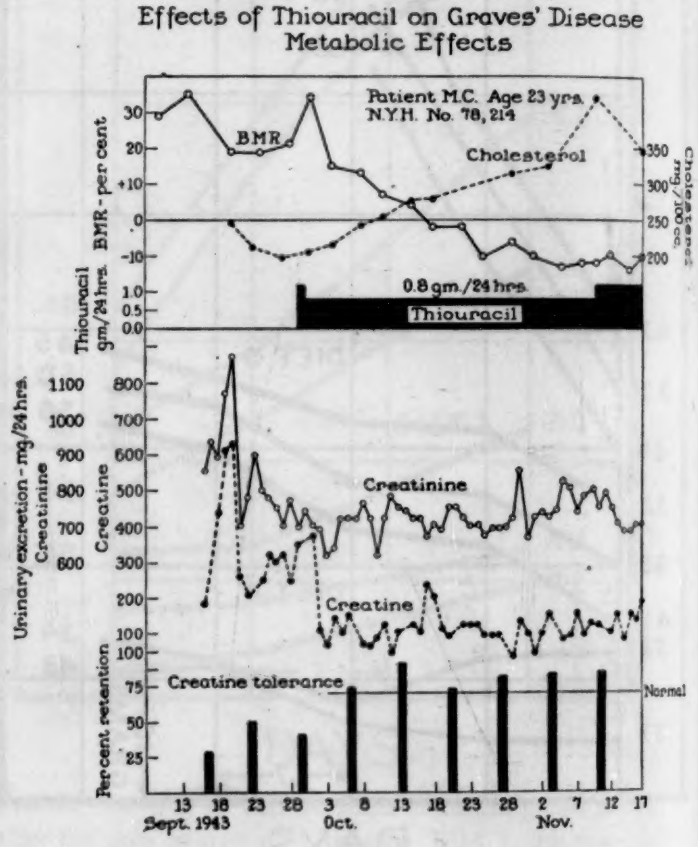


FIG. 2

The creatinuria was sharply reduced from control levels; however, it still persisted at somewhat higher than the average normal levels. The creatin tolerance following the administration of 1.32 gm of creatin rose rapidly to, and remained within, the normal range. An increase in creatinine excretion was not observed but was not anticipated over this short period. Sugar tolerance tests were normal before treatment and remained so. Nitrogen, phosphorus and calcium balances became progressively more positive. The im-

provement in calcium balance occurred chiefly from a reduction in calcium excretion in the stool. In another patient of this series, however, the chief reduction in calcium excretion after thiouracil took place in the urine, calcium content of which fell from the control level, 575 mgs, to the neighborhood of 214 mgs per 24 hours. No changes were noted in the size of the gland or degree of exophthalmos. The purpose of the increased dosage of thiouracil during the last week was to ascertain the degree of thyroid insufficiency which could be achieved; although the basal metabolic rate still remained at −10 per cent. to −15 per cent., serum cholesterol rose to myxedematous levels of 350–415 mgs per cent. during this period.

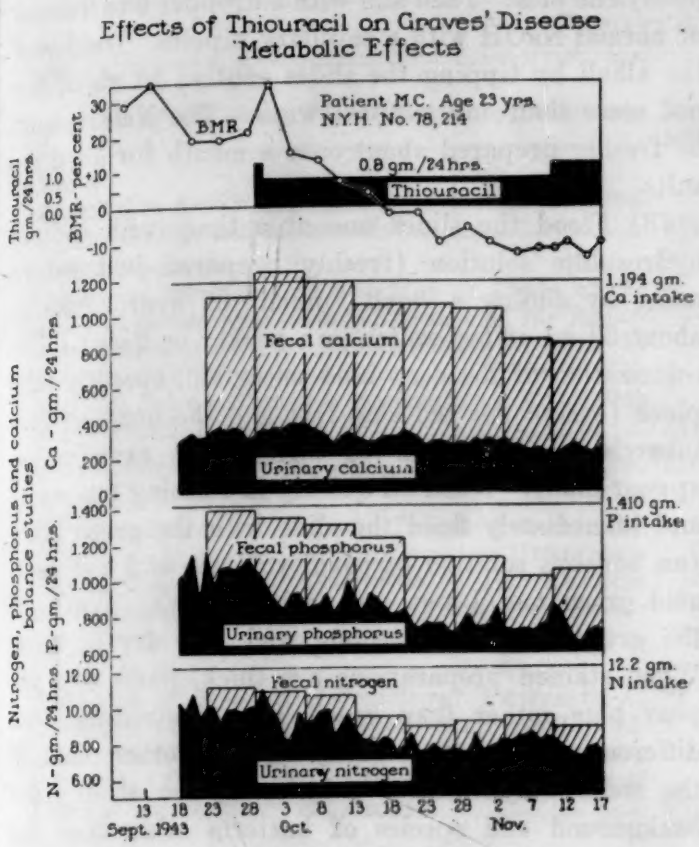


FIG. 3

No toxic manifestations were encountered in this patient. In another patient of the series, mild jaundice with an icteric index of 23 developed after 20 days of thiouracil (0.8 gm daily). There was no demonstrable evidence of hemolysis or hepatic damage at the time. Subsequent gall bladder x-rays and liver function tests were entirely normal. There was a return of the icteric index to normal within 10 days of stopping the drug. Two other patients of a series of 12 treated with thiouracil developed urticarial eruptions which disappeared on discontinuing the drug and reappeared in one of the two patients when treatment was reinstituted a week later. The possibility of toxic hepatitis appears to warrant routine icteric indices during at least the initial stages of treatment.

In conclusion, the effects of thiouracil on the disturbances of calcium, phosphorus, nitrogen and creatin metabolism occurring in Graves' disease are comparable to the beneficial results following successful subtotal thyroidectomy or iodine remission. These findings indicate the physiological nature of the remission produced by this new chemotherapeutic agent.

MARGARET H. SLOAN
EPHRAIM SHORR

# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A DIFFERENTIAL TRIPLE STAIN FOR DEMONSTRATING AND STUDYING NON-ACID-FAST FORMS OF THE TUBERCLE BACILLUS IN SPUTUM, TISSUE AND BODY FLUIDS[1]

IN 1932, non-acid-fast forms of the tubercle bacillus[2] were studied by means of several improved counterstain technics. One was devised which gave the most striking results of all for differentiating the acid-fast and non-acid-fast rods and granules.[3] It consisted in staining first by the usual Ziehl-Neelsen method, decolorizing with acid alcohol and then adding to each slide, flooded wth Loeffler's methylene blue counterstain, 6 to 8 drops of an experimentally determined optimum strength of NaOH (0.05 per cent. for avian strains and 4 per cent. (normal strength) for human strains). Whereas this counterstain method was excellent for pure cultures of tubercle bacilli, it was unsuitable for use with sputum, tissues or body fluids, since the background took on and held an intensely blue color which obscured the contrast; thus any other species of bacteria present would also appear blue.

An attempt was made, therefore, to find some means of bleaching out the methylene blue from the background without removing the blue color from the non-acid-fast forms of the tubercle bacilli. Tests were made on pure cultures of tubercle bacilli and of tubercle bacilli mixed with a number of other organisms, including staphylococci, streptococci and *C. diphtheriae*. Controls were made by staining pure cultures of these non-acid-fast species alone. An excellent bleaching agent was found. It is sodium hydrosulfite, a substance used as a discharge or "stripping" agent in the textile industry. This substance in

[1] This work was supported by a grant from the Rosenwald Family Association, and was carried on mainly in the laboratories of Dr. Morton C. Kahn, Department of Public Health and Preventive Medicine, Cornell University Medical College.

[2] M. C. Kahn, *Am. Rev. Tuber.*, 20: 2, 150, 1929; E. G. Alexander, *Proc. Soc. Exp. Biol. and Med.*, 21: 1104, 1934; M. B. Lurie, *Jour. Exp. Med.*, 69: 576, 1939.

[3] E. G. Alexander, SCIENCE, 75: 197, 1932.

a strength of approximately 0.25 per cent. (or a small pinch in about 50 ml of tap water *freshly* prepared *just* before using, selectively bleached the blue color from the background and from all the organisms tested excepting the tubercle bacilli, without affecting the red color of the carbol-fuchsin stained rods or the blue color of the methylene-blue stained non-acid-fast forms of *M. tuberculosis*.

Subsequently, known pure cultures of tubercle bacilli were mixed with non-tuberculous sputums and were stained by the new technic. The results were striking. Acid-fast organisms were red, non-acid-fast forms were blue, partially acid-fast forms mulberry color, while other organisms, tissue cells and mucus formed an effective light green background with the third stain used; this consists of equal volumes of aqueous solutions of 1 per cent. acid green[4] and 1 per cent. acid yellow.[4] Every slide stained by the triple staining method was controlled by a duplicate smear stained by the ordinary Ziehl-Neelsen technic. Thereafter, hundreds of slides of tuberculosis sputum, tissue and body fluids—particularly chest fluids[5]—were stained by the triple stain technic with Ziehl-Neelsen controls, with satisfactory results.

This triple method of staining should be a useful supplement to the usual Ziehl-Neelsen technic since it reveals a number of interesting non-acid-fast forms which ordinarily escape observation.[6] One of these forms is zoogleal, consisting of one or more granules embedded or enmeshed in amorphous material and is not stained by the usual Loeffler's methylene blue or dilute methylene blue counterstains. This form, stained and unstained, has been the subject of intensive study and is being described in detail elsewhere. Ubiquitous saprophytic diphtheroids obtained from a variety of non-tuberculous materials such as normal guinea-pig serum or heart's blood, tap water, or hay, apparently are also able to enter a zoogleal state similar to this newly demonstrated zoogleal state of *M. tuberculosis*, and are distinguished from *M. tuberculosis* by the relative ease and speed with which such forms develop into rods on culture, the non-acid-fast character of all their rod forms, and, of course, by their complete lack of pathogenicity for the guinea pig.

### Technic of the Triple Stain for Tubercle Bacilli

(1) Prepare smears which are not too thick, fix carefully with heat, and stain as usual three minutes with carbol-fuchsin.[7] Decolorize for one to three minutes with acid alcohol (3 per cent. HCl) and wash thoroughly in running tap water.

(2) Flood the slides with a well-ripened Loeffler's methylene blue. Then add with a dropper 6 to 8 drops of normal NaOH with a capillary pipette. Distribute the alkali by tipping the slides gently; let stand for not more than one minute; wash. The NaOH must be freshly prepared about once a month for good results.

(3) Flood the slides one at a time, with sodium hydrosulfite solution (freshly prepared just before using by adding a small "pinch" of hydrosulfite to about 50 ml of tap water in a beaker or flask). Decolorization of the deep blue smear will speedily take place (except for red acid-fast and the non-acid-fast tubercle bacilli, which on microscopic examination appear blue). Wash off quickly in running tap water and immediately flood the slide with the green stain (an aqueous solution of equal volumes of 1 per cent. acid green and 1 per cent. acid yellow). Wash off the green in a few seconds, and blot dry at once. When stained preparations are thick, parts will appear blue rather than green, thus preventing clear differentiation in those areas. On the other hand, if the sodium hydrosulfite solution is too strong, the background and species of bacteria other than the tubercle bacillus will appear grayish.

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[4] National Acid Green L Extra, C.I. No. 666 and National Quinoline Yellow C.I. No. 801 were found suitable.

[5] Most of the material was obtained from the laboratory of Tuberculosis Service at Bellevue Hospital through the kindness of Dr. J. Burns Amberson, director, and Miss Edna Stein, bacteriologist.

[6] E. Alexander-Jackson, *Am. Rev. Tuber.*, 33: 6, 789, 1936.

[7] To protect smears against precipitated particles of carbol-fuchsin stain, it is advisable to lay a strip of clean filter paper across each fixed smear prior to adding the dye.

## BOOKS RECEIVED

Barton, Wm. H., Jr. *World Wide Planisphere for Finding and Identifying Navigation Stars and Constellations from all Latitudes, North or South throughout the Year.* Addison-Wesley Press, Inc. $2.50.

Barton, Wm. H., Jr., and Charles O. Roth, Jr. *Basic Problems in Celestial Navigation.* Illustrated. Pp. 56. Addison-Wesley Press, Inc. $1.00.

Chapin, William H. *Exercises in Second Year Chemistry.* Fourth edition. Revised by Werner E. Bromund and L. E. Steiner. Illustrated. Pp. vii + 216. John Wiley and Sons, Inc.

*Contributions to American Anthropology and History.* Illustrated. Pp. 260. Publication No. 546 of the Carnegie Institution of Washington. $3.50, paper cover; $4.00, cloth binding.

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